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(54) LOCK MECHANISM WITH BIASING STRUCTURE FOR AUTOMOTIVE SEAT SLIDE DEVICE

(57) A biasing structure for basing a locking pawl-equipped operation rod (39) in a given direction is described. A slit (57) is formed in a rear end of the operation rod. A spring retainer (50) is integrally provided by a bracket (41) through which the operation rod is rotatably connected to a movable rail. The spring retainer includes a rearwardly projected portion (49) whose on surface faces toward a rear end portion of the operation rod and a recess (55) which is formed in a base part of the projected portion and faces toward the rear end portion of the operation rod. A coil spring (53) includes a multi-turned major portion (53a), a front straight portion (53d) tangentially extending from a front end of the major portion and a rear straight portion (53c) extending radially inward from a rear end of the major portion. Upon assembly of the coil spring, the major portion thereof is disposed on the rear end portion of the operation rod with the front straight portion put in the recess and with the rear straight portion put in the slit while being twisted about its axis against a biasing force produced by the spring. The surface of the rearwardly projected portion is sized and arranged to support the front straight portion of the coil spring when the coil spring is about to be properly assembled.

FIG.4

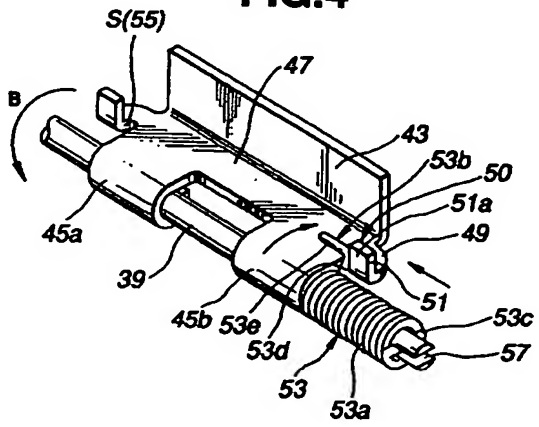

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FIG.1

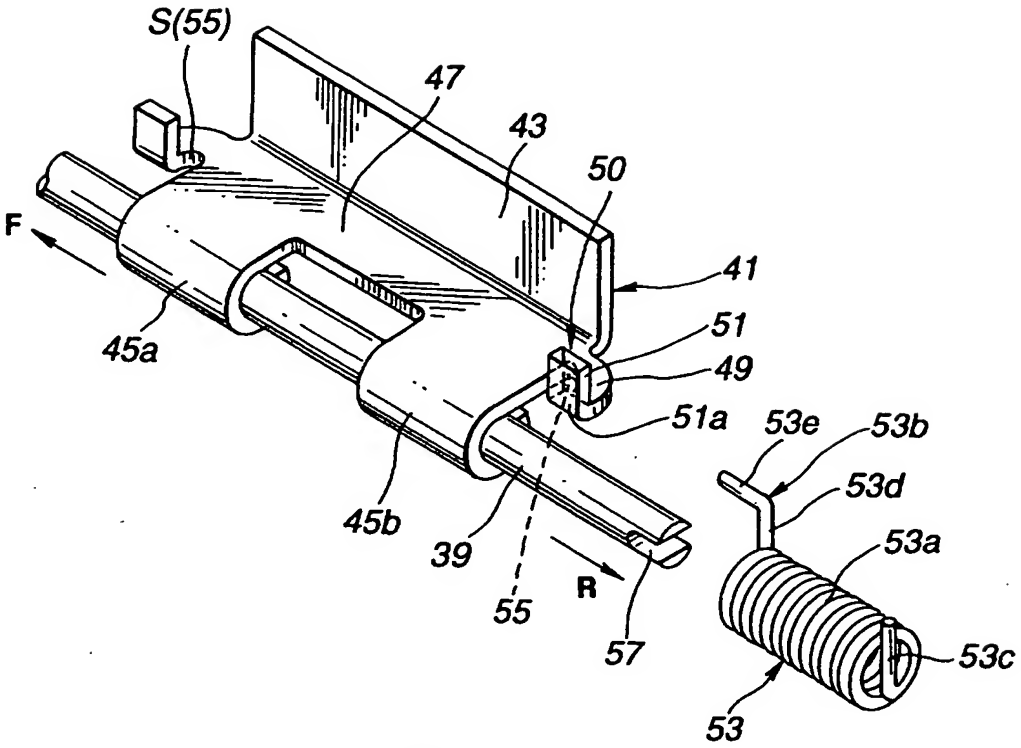

S(55)
47
43
50
41
F
51
49
45a
51a
53e
53b
53d
45b
39
53a
R
55
57
53c
53

FIG.2

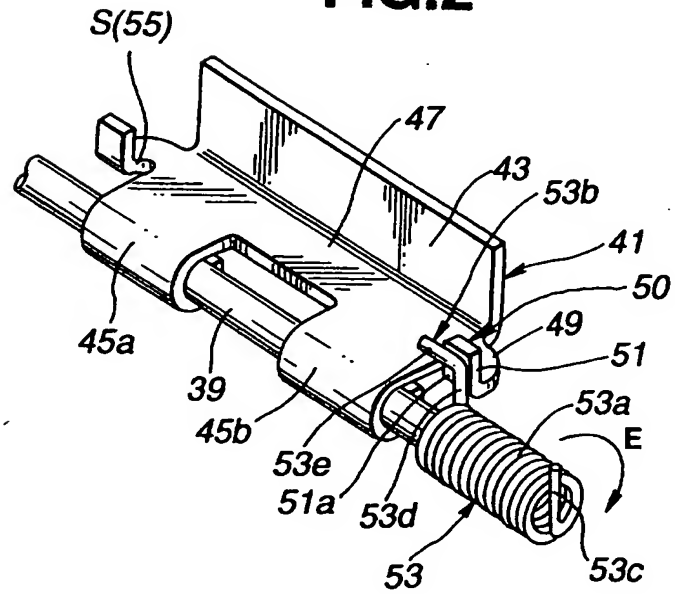

S(55)
47
43
53b
41
50
49
45a
51
39
53a
E
45b
53e
51a
53d
53
53c

FIG.3

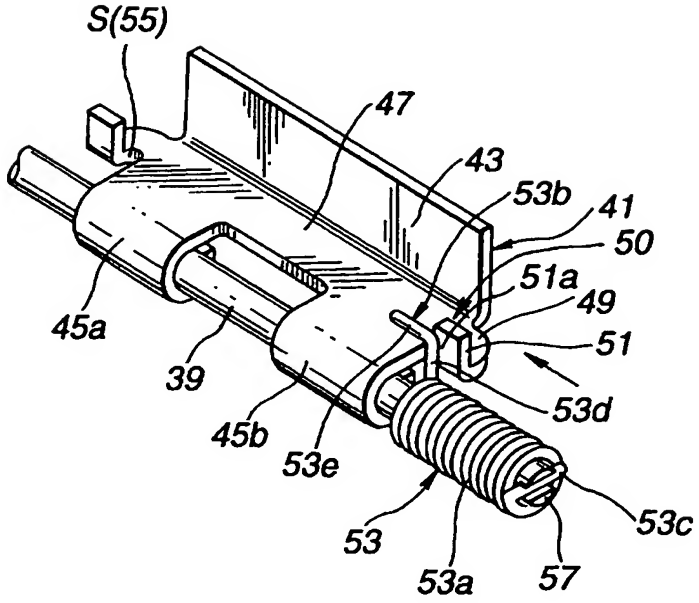

S(55)
47
43
53b
41
50
51a
49
51
53d
45a
39
45b
53e
53
53a
57
53c

FIG.4

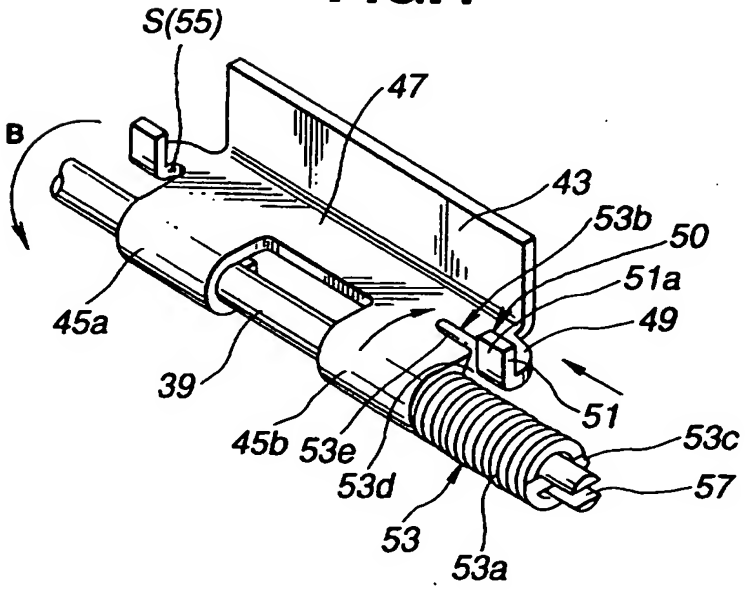

S(55)
47
B
43
53b
50
51a
49
45a
39
51
53c
45b
53e
53d
57
53
53a

FIG.5A

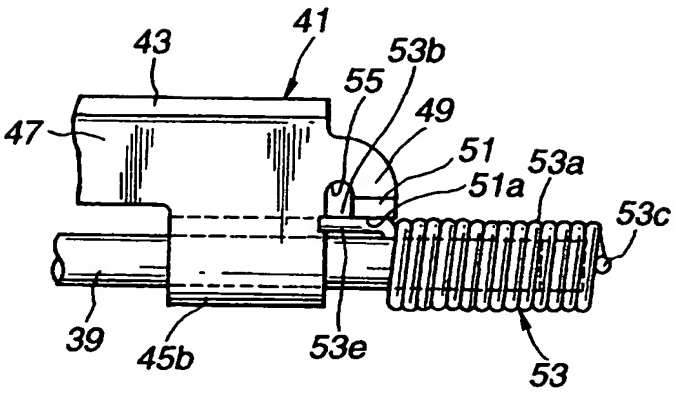


FIG.5B

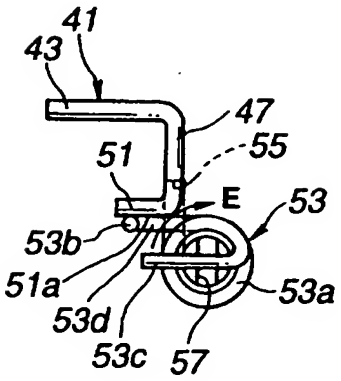


FIG.5C

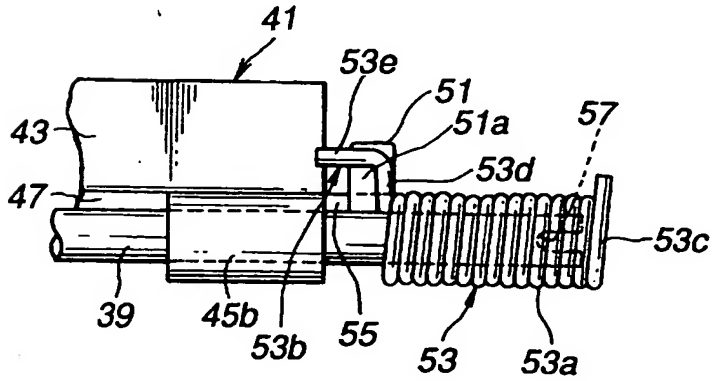


FIG.6A

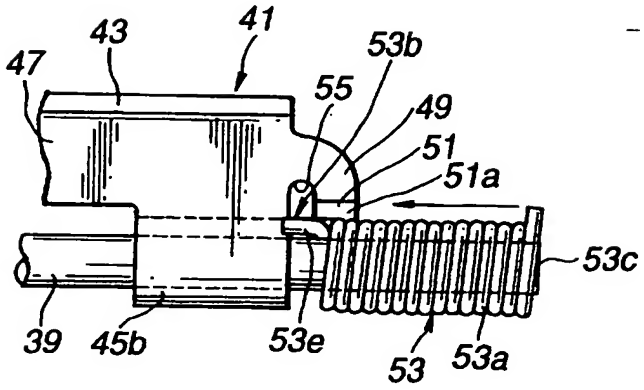


FIG.6B

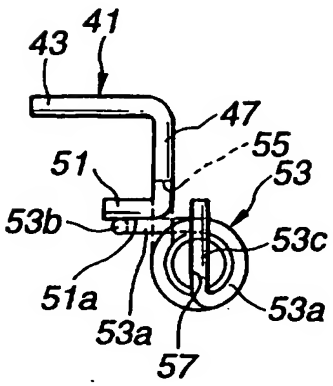


FIG.6C

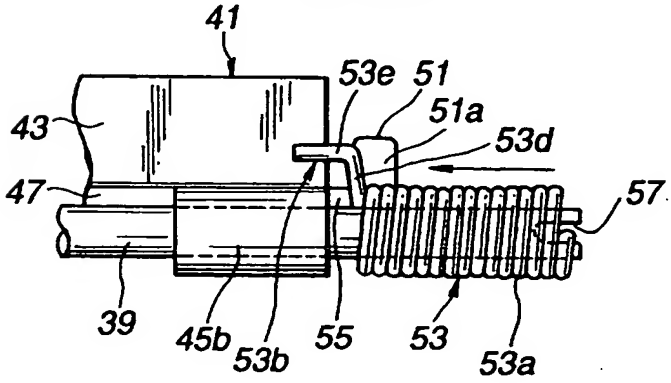


FIG.7A

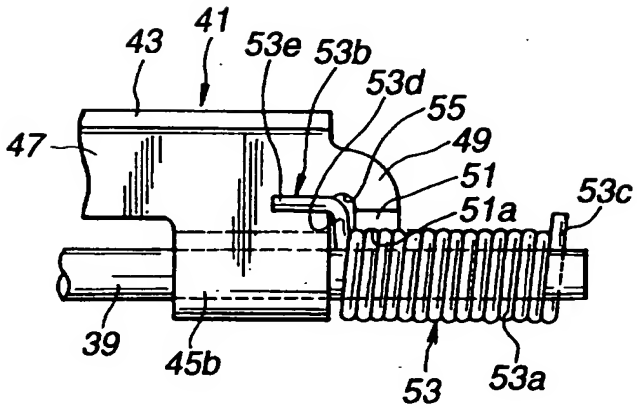


FIG.7B

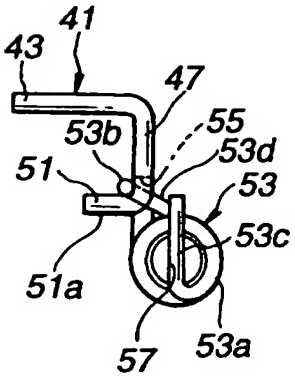


FIG.7C

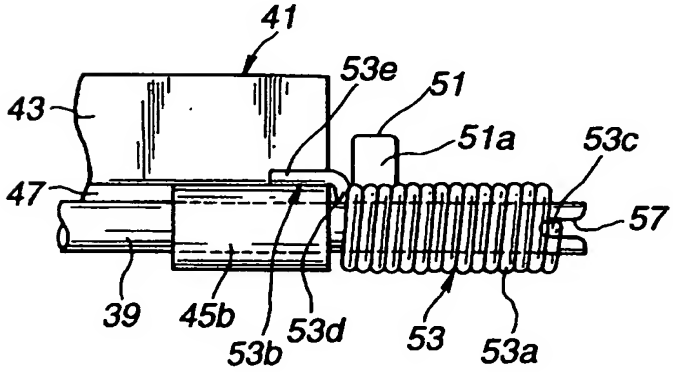
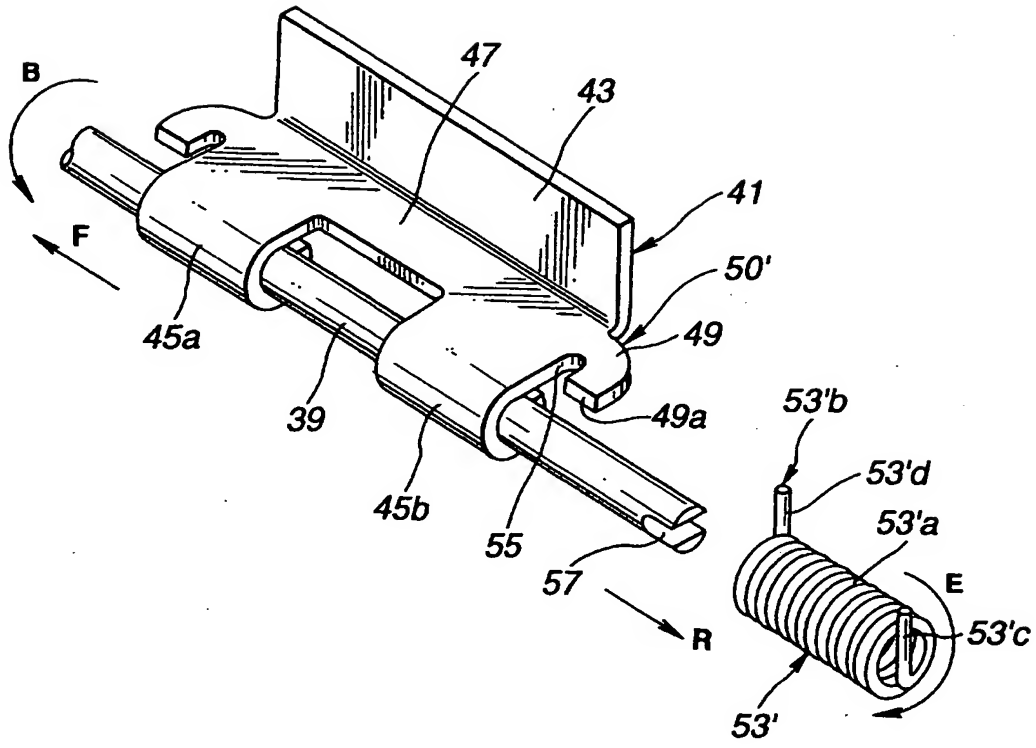


FIG.8



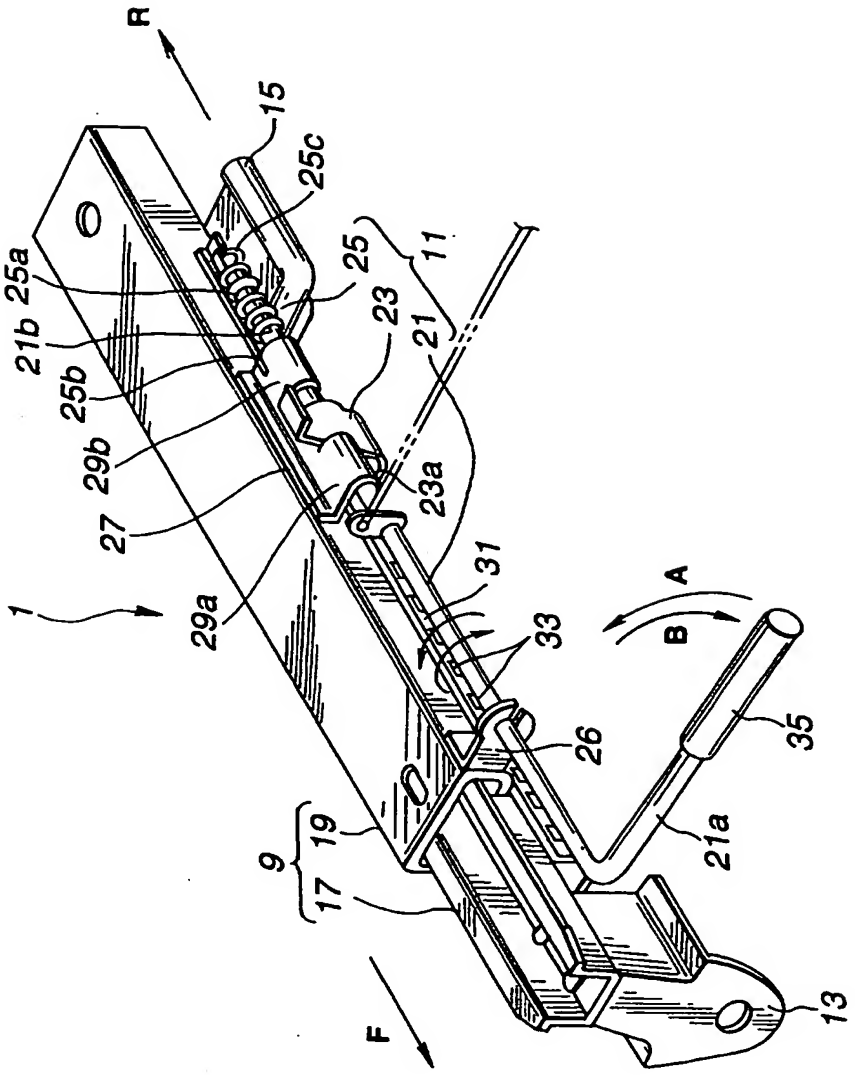


FIG.9
(PRIOR ART)

FIG.10

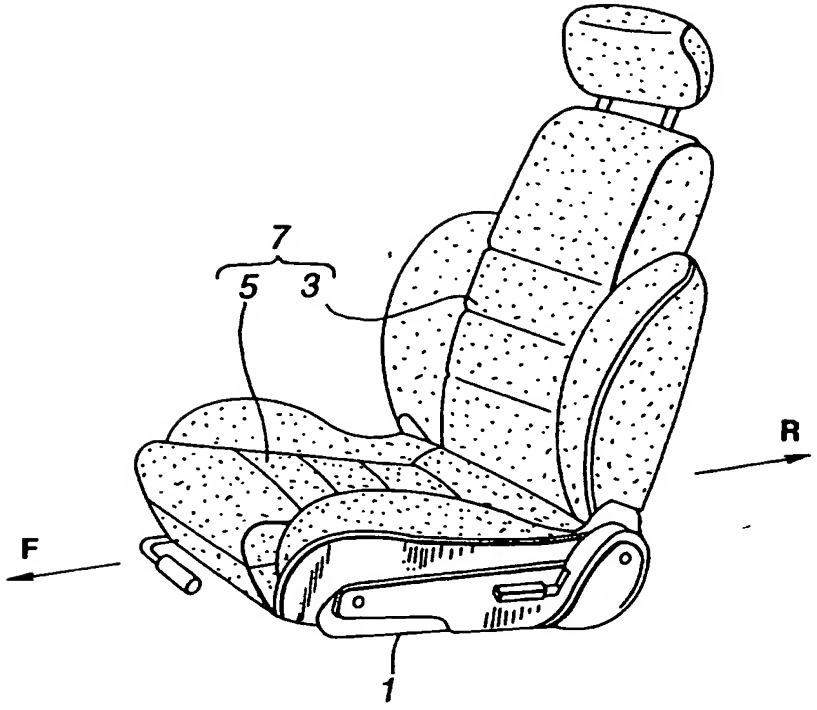


FIG.11
(PRIOR ART)

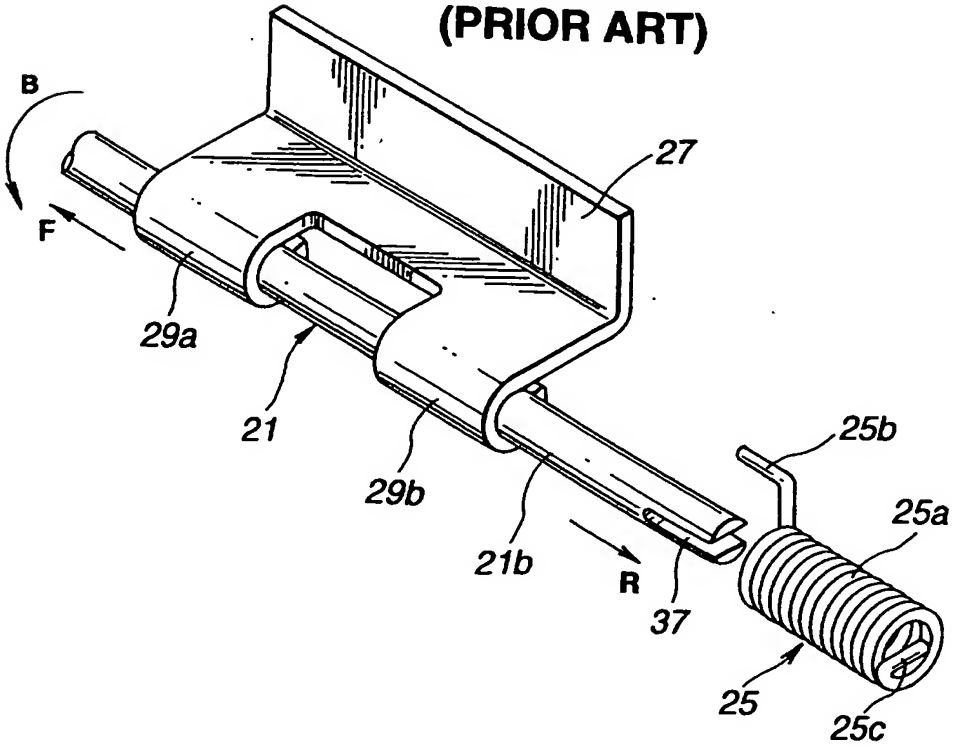


FIG.12A

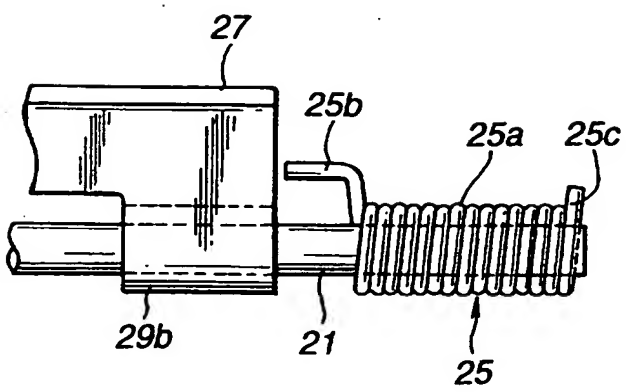


FIG.12B

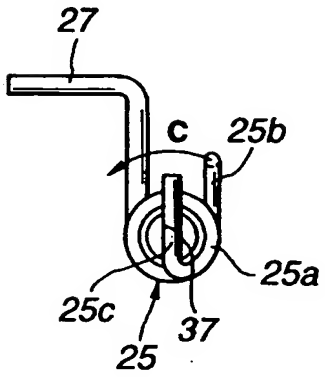


FIG.12C

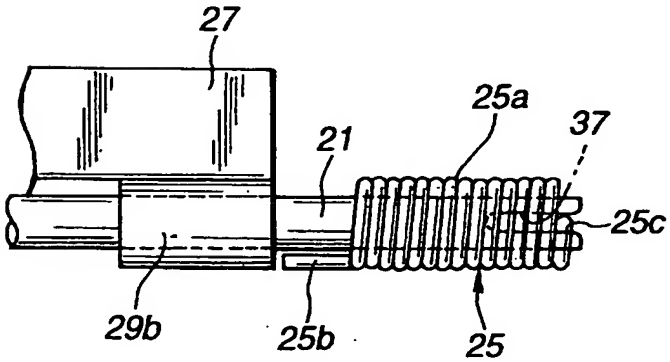


FIG.13A

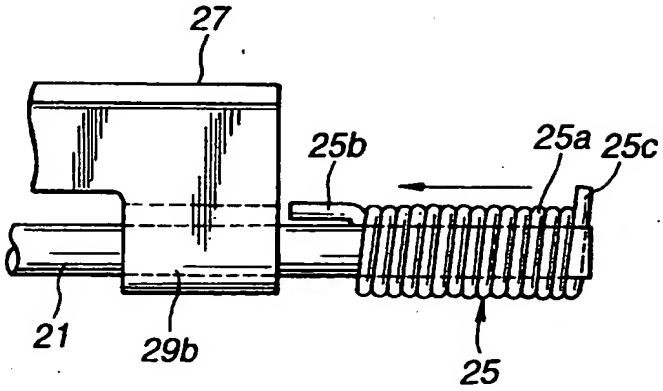


FIG.13B

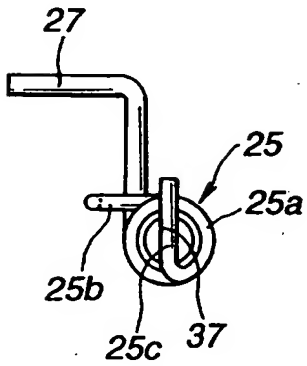


FIG.13C

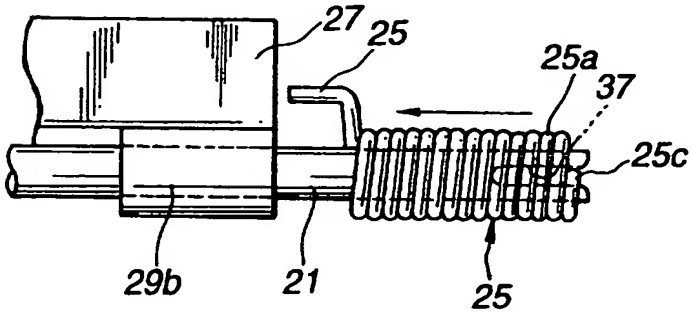


FIG.14A

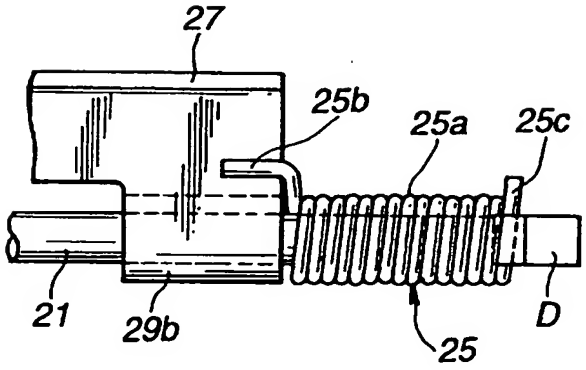


FIG.14B

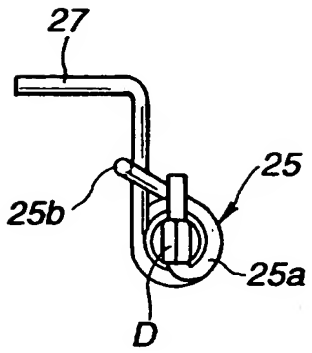
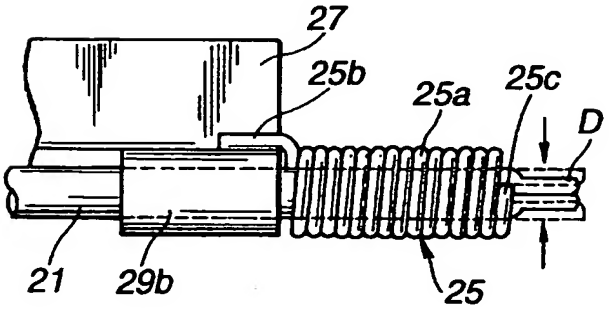


FIG.14C



BIASING STRUCTURE OF LOCK MECHANISM IN AUTOMOTIVE SEAT SLIDE DEVICE

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates in general to an automotive seat slide device which can slide the seat to a desired fore-and-aft position relative to a vehicle floor, and more particularly to a lock mechanism of the seat slide device by which the seat can be locked at the desired position. More specifically, the present invention is concerned with a biasing structure for biasing a locking pawl operation rod of the lock mechanism in a locking direction.

2 Description of the Prior Art

In order to clarify the task of the present invention, one conventional biasing structure of a lock mechanism in an automotive seat slide device will be described with reference to Figs. 9 to 14 of the accompanying drawings.

In Fig. 10, there is shown a seat 7 for a motor vehicle, to which the seat slide device 1 is practically applied. The seat 7 generally comprises a seat cushion 5 and a seatback 3. The seat slide device 1 is arranged below the seat cushion 5 to permit the seat 7 to slide forward "F" and rearward "R" relative to a vehicular floor (not shown).

As will be understood from Fig. 9, the seat slide device 1 generally comprises two laterally spaced slide units 9 (only the right side unit is shown) and a lock mechanism 11 incorporated with the right slide unit 9.

As is understood from Fig. 9, each slide unit 9 comprises a lower rail 17 which is secured to a vehicle floor (not shown) through front and rear mounting brackets 13 and 15, and an upper rail 19 which is axially slidably engaged with the lower rail 17. The upper rail 19 has the seat 7 mounted thereon.

The lock mechanism 11 comprises an operation rod 21 which extends along the upper rail 19 and is rotatable about its axis. That is, the operation rod 21 is rotatably held by the upper rail 19 through front and rear brackets 26 and 27. As shown, the rear bracket 27 includes two spaced bearing portions 29a and 29b by which a relatively rear part of the operation rod 21 is rotatably held. Within a space defined between the two bearing portions 29a and 29b, there is arranged a locking pawl 23 which is secured to the operation rod 21 to rotate therewith. A pawl proper of the locking pawl 23 is denoted by numeral 23a in the drawing. The operation rod 21 has a normally bent front part 21a which is equipped with a handle 35.

The lock mechanism 11 further comprises an elongate plate 31 which extends along the lower rail 17 and is secured to the same. The elongate plate 31 is formed with a plurality of aligned locking openings 33 with which the locking pawl 23 (more specifically, the pawl proper 23a) is selectively engageable.

A biasing structure is incorporated with the operation rod 21 to bias the same in a direction to achieve the locked engagement of the locking pawl 23 with one of the locking openings 33. The biasing structure employs a biasing spring 25 of coil type, which is disposed about a rear end portion of the operation rod 21. The detail of this conventional biasing structure will be described hereinafter.

When the lock mechanism 11 is in a locked condition as shown in Fig. 9, the locking pawl 23 is kept engaged with one of the locking openings 33 under the force of the biasing spring 25. In this condition, the upper rail 19 (thus, the seat 7 mounted thereon) is locked at a certain fore-and-aft position relative to the lower rail 17 (that is, the vehicle floor).

Thus, when the handle 35 is turned upward in the direction of the arrow "A" in Fig. 9 against the force of the biasing spring 25, the locking pawl 23 is released from the locking opening 33 canceling the locked condition of the lock mechanism 11. Under

this released condition, the upper rail 19 is permitted to freely move relative to the lower rail 17.

Fig. 11 is an illustration for explaining the biasing structure of the lock mechanism 11. For clarification of the drawing, the locking pawl 23 secured to the operation rod 21 is not illustrated. As is described hereinabove, the biasing spring 25 is a coil spring disposed about the rear end portion 21b of the operation rod 21 to bias the same in the locking direction, that is, in a direction of the arrow "B" in Fig. 9.

As shown, the biasing spring 25 comprises a multi-turned major portion 25a, a cranked arm portion 25b which projects forward from a front end of the major portion 25a and an inwardly bent portion 25c which is bent radially inward from a rear end of the major portion 25a. The rear end of the operation rod 21 is formed with an axially extending slit 37.

When the biasing spring 25 is properly assembled, that is, when the multi-turned major portion 25a thereof is deeply disposed on the rear end portion of the operation rod 21 having the inwardly bent portion 25c put in the slit 37 and the cranked arm portion 25b put on an upper surface of the bracket 27 while being twisted by a certain degree against a force produced by the spring 25, the operation rod 21 is biased in the direction of the arrow "B", that is, in the direction to achieve the locked engagement between the locking pawl 23 and one of the locking openings 33.

For properly assembling the biasing spring 25, the following assembling steps have been employed, which will be described with reference to Figs. 12A to Fig. 14C. It is to be noted that Figs. 12A,13A and 14A are plan views of the biasing structure of Fig. 11, Figs. 12B, 13B and 14B are side views of the biasing structure and Figs. 12C, 13C and 14C are bottom views of the biasing structure.

First, as is seen from Figs. 12A, 12B and 12C, the biasing spring 25 is loosely put on the rear end portion of the operation

rod 21 and slightly turned about the same, and then slightly slid toward the bracket 27 to such a position as to establish a shallow engagement of the inwardly bent portion 25c with the slit 37. In this condition, the cranked arm portion 25b is still separated from the bracket 27, as is seen from Figs. 12A and 12C. Then, as is seen from Fig. 12B, with the inwardly bent portion 25c kept shallowly engaged with the slit 37, the cranked arm portion 25b is turned or raised in a direction of the arrow "C" against a biasing force produced by the spring 25. Then, as is seen from Figs. 13A and 13C, with the cranked arm portion 25b kept raised, the biasing spring 25 is slid toward the bracket 27. During this, the inwardly bent portion 25c of the spring 25 slides in the slit 37 keeping the engagement therebetween. When, as is seen from Figs. 14A, 14B and 14C, the biasing spring 25 is slid to the frontmost position, the cranked arm portion 25b is released to be put on an upper surface of the bracket 27. In this condition, the inwardly bent portion 25c assumes the deepest position in the slit 37.

Finally, as is best seen from Figs. 14B and 14C, the slit-provided rear end of the operation rod 21 is caulked to form a caulked end "D". With this caulked end "D", the inwardly bent portion 25c of the spring 25 is tightly retained in the deepest position of the slit 37, and thus the biasing spring 25 is assuredly retained on the operation rod 21.

However, due to its inherent construction, the above-mentioned biasing structure has the following drawback. That is, in order to retain the biasing spring 25 on the operation rod 21, it is inevitably necessary to caulk the slit-provided rear end of the operation rod 21. As is known, caulking process is troublesome and thus causes a lowering of assembling efficiency of the biasing structure and thus that of the seat slide device.

SUMMARY OF THE INVENTION

It is therefore an object of the present invention to provide a biasing structure of a lock mechanism in an automotive seat

slide device, which can assuredly retain a biasing spring in a proper assembled position without caulking the slit-provided rear end of a control rod.

According to a first aspect of the present invention, there is provided a biasing structure for use in a lock mechanism of an automotive seat slide device having a bracket through which an operation rod is rotatably connected to a movable rail, a locking pawl secured to the operation rod to move therewith and a plurality of locking openings possessed by a fixed rail, the locking pawl being engageable with the locking openings, upon rotation of the operation rod in a given direction, to establish a locked condition of the movable rail relative to the fixed rail. The biasing structure biases the operation rod in the given direction and comprises an axially extending slit formed in a rear end portion of the operation rod; a spring retainer integrally provided by a rear end of the bracket, the spring retainer including a rearwardly projected portion whose one surface faces toward the rear end portion of the operation rod and a recess which is formed in a base part of the projected portion and faces toward the rear end portion of the operation rod; a coil spring including a multi-turned major portion, a front straight portion which tangentially extends from a front end of the major portion and a rear straight portion which extends radially inward from a rear end of the major portion, wherein, upon proper assembly of the coil spring, the major portion thereof is disposed on the rear end portion of the operation rod with the front straight portion put in the recess and with the rear straight portion put in the slit while being twisted about its axis against a biasing force produced by the spring, and wherein the surface of the rearwardly projected portion of the spring retainer is sized and arranged to support the front straight portion of the coil spring when the coil spring is about to be properly assembled.

According to a second aspect of the present invention, there is provided a lock mechanism of an automotive seat slide

device having a movable rail movable on a fixed rail. The lock mechanism comprises a bracket secured to the movable rail and having two spaced bearing portions; an operation rod rotatably held by the bearing portions; a locking pawl secured to the operation rod at a position between the spaced bearing portions; an elongate plate secured to the fixed rail, the elongate plate having a plurality of locking openings with which the locking pawl is engageable upon rotation of the operation rod in a given direction; an axially extending slit formed in a rear end portion of the operation rod; a spring retainer integrally provided by a rear end of the bracket, the spring retainer including a rearwardly projected portion whose one surface faces toward the rear end portion of the operation rod and a recess which is formed in a base part of the projected portion and faces toward the rear end portion of the operation rod; a coil spring including a multi-turned major portion, a front straight portion which tangentially extends from a front end of the major portion and a rear straight portion which extends radially inward from a rear end of the major portion, wherein, upon proper assembly of the coil spring, the major portion thereof is disposed on the rear end portion of the operation rod with the front straight portion put in the recess and with the rear straight portion put in the slit while being twisted about its axis against a biasing force produced by the spring, and wherein the surface of the rearwardly projected portion of the spring retainer is sized and arranged to support the front straight portion of the coil spring when the coil spring is about to be properly assembled.

BRIEF DESCRIPTION OF THE DRAWINGS

Other objects and advantages of the present invention will become apparent from the following description when taken in conjunction with the accompanying drawings, in which:

Fig. 1 is a perspective view of a biasing structure of a first embodiment of the present invention, showing a condition wherein a biasing spring is about to be assembled;

Fig. 2 is a view similar to Fig. 1, but showing a first incompletely assembled condition of the biasing spring;

Fig. 3 is a view similar to Fig. 1, but showing a second incompletely assembled condition of the biasing spring;

Fig. 4 is a view similar to Fig. 1, but showing a completely assembled condition of the biasing spring;

Figs. 5A, 5B and 5C are plan, side and bottom views of the biasing structure of the first embodiment in a state wherein the biasing spring assumes the first incompletely assembled condition of Fig. 2;

Figs. 6A, 6B and 6C are plan, side and bottom views of the biasing structure of the first embodiment in a state wherein the biasing spring assumes the second incompletely assembled condition of Fig. 3;

Figs. 7A, 7B and 7C are plan, side and bottom views of the biasing structure of the first embodiment in a state wherein the biasing spring assumes the completely assembled condition of Fig. 4;

Fig. 8 is a view similar to Fig. 1, but showing a biasing structure of a second embodiment of the present invention;

Fig. 9 is a perspective view of a slide unit having a lock mechanism with which a conventional biasing structure is incorporated;

Fig. 10 is a perspective view of an automotive seat to which the slide unit of Fig. 9 is applied;

Fig. 11 is a perspective view of the conventional biasing structure;

Figs. 12A, 12B and 12C are plan, side and bottom views of the conventional biasing structure in a state wherein the biasing spring assumes a first incompletely assembled condition;

Figs. 13A, 13B and 13C are plan, side and bottom views of the conventional biasing structure in a state wherein the biasing spring assumes a second incompletely assembled condition; and

Figs. 14A, 14B and 14C are plan, side and bottom views of the conventional biasing structure in a state wherein the biasing spring assumes a completely assembled condition.

DETAILED DESCRIPTION OF THE EMBODIMENTS

Referring to Figs. 1 to 7, particularly Fig. 1, there is shown a biasing structure which is a first embodiment of the present invention. Like the above-mentioned conventional biasing structure of Fig. 11, the biasing structure of this invention is incorporated with a lock mechanism of a seat slide device, such as the lock mechanism 11 shown in Fig. 9.

In Fig. 1, denoted by references "F" and "R" are forward and rearward directions defined with respect to a seat slide device with which the biasing structure of the invention is incorporated. In the following description, the terms "forward", "rearward", "front", "rear", "inboard", "outboard" and the like are to be understood with respect to the seat slide device.

As is shown in Fig. 1, a bracket 41 includes a vertical wall portion 43 which is secured to a side wall of an upper rail (11, see Fig. 9), a horizontal flat portion 47 which extends inward from a lower end of the vertical wall portion 43, and two spaced curved bearing portions 45a and 45b which extend outward from the horizontal flat portion 47 for rotatably holding a relatively rear part of an operation rod 39. For clarification, a locking pawl secured to the operation rod 39 at the space between the spaced two bearing portions 45a and 45b is not illustrated.

As shown, the horizontal flat portion 47 of the bracket 41 is formed at its rear end with a spring retainer 50. The spring retainer 50 comprises a horizontal part 49 which protrudes rearward from the rear end of the horizontal flat portion 47 and a vertical part 51 which extends upward from an inboard end of the horizontal part 49. Thus, an inside surface 51a of the vertical part 51 faces toward the operation rod 39, as shown.

A front edge of the vertical part 51 is separated from the rear end of the horizontal flat portion 47 due to presence of a

recess 55 which is formed in the horizontal part 49. The position and shape of the recess 55 may be well understood when reference is made to a front slit which is indicated by reference "R" in the drawing. In fact, at a front end of the horizontal flat portion 47, there is also provided a similar spring retainer, as shown.

As will become apparent as the description proceeds, the inboard surface 51a of the vertical part 51 serves as a temporarily supporting surface, and the recess 55 of the horizontal part 49 serves to retain a biasing spring 53.

The biasing spring 53 is of a coil type, which comprises a multi-turned major portion 53a, a cranked arm portion 53b projecting forward from a front end of the major portion 53a and an inwardly bent portion 53c projecting radially inward from a rear end of the major portion 53a. For the reason which will become apparent as the description proceeds, the length of the inwardly bent portion 53c is somewhat greater than that of the biasing spring 25 of the above-mentioned conventional biasing structure. The cranked arm portion 53b comprises a tangentially extending straight part 53d which extends tangentially from the front end of the major portion 53a and an axially extending straight part 53e which extends forward form a leading end of the tangentially extending straight part 53d, as shown.

When the biasing spring 53 is properly assembled, the same assumes such a condition as shown in Fig. 4. That is, in this condition, the multi-turned major portion 53a is deeply disposed on the rear end portion of the operation rod 39 having the inwardly bent portion 53c put in the slit 57 and the cranked arm portion 53b put in the slit 37 while being twisted by a certain degree against a force produced by the spring 53. Thus, the operation rod 39 is biased in the direction of the arrow "B", that is, in a direction to achieve a locked engagement between the locking pawl (not shown) and one of the locking openings (not shown).